

# TEMPERATURE / PROCESS CONTROLLER

## MODELS: SCS60, SCM60, SCN60, SCL60

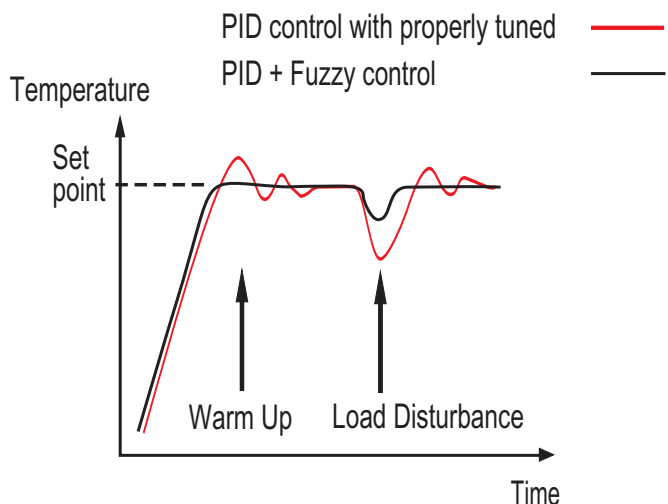
- EASY TO USE
- FUZZY MODIFIED PID AND HEAT & COOL CONTROL
- FAST SAMPLING RATE (5 TIMES/S)
- UNIVERSAL INPUT WITH HIGH ACCURACY 18-BIT A / D
- ANALOGUE OUTPUT WITH HIGH ACCURACY 15-BIT D / A
- RS-485 / 232 COMMUNICATION
- AUTO-TUNE FUNCTION
- AUTO / MANUAL FUNCTION
- BUMPLESS TRANSFER
- FRONT PANEL, PC AND HAND-HELD DEVICE PROGRAMMABLE
- TWO BRIGHT EASY TO READ 4-DIGIT LED DISPLAY
- RELAYS, PULSED OUTPUT TO DRIVE SSR, ISOLATED CURRENT, ISOLATED VOLTAGE AND TRIAC OUTPUT
- FOUR LEVELS OF LOCKOUT PROTECTION CONTROL
- DIGITAL FILTER TO IMPROVE THE STABILITY OF PROCESS VALUE
- SOFT - START RAMP
- 1/16 DIN, 72 X 72 DIN, 1/8 DIN AND 1/4 DIN SIZE PANEL MOUNT
- CSA / UL / CE APPROVED



## BENEFITS OF FUZZY MODIFIED PID TECHNOLOGY

By using proprietary Fuzzy modified PID technology, the control loop will minimize the overshoot and undershoot in the shortest time.

### COMPARISON OF RESULTS WITH AND WITHOUT FUZZY TECHNOLOGY



## INTRODUCTION

The SC60 Fuzzy Logic plus PID Microprocessor based Process / Temperature Controller incorporates two bright, easy to read 4-digit LED displays, indicating process and set point values. The Fuzzy Logic technology enables a process to reach a predetermined set point in the shortest time, with the minimum of overshoot during power-up or external load disturbance.

SCS60, SCN60, SCM60 and SCL60 are 1/16 DIN, 72X72 DIN, 1/8 DIN and 1/4 DIN size panel mount controllers, respectively. These units are powered by 11-26 or 90-264 VDC / VAC supply, incorporating a 2 Amp. control relay output as standard. A second output can be used as cooling control, or an alarm. Both outputs can be selected to be triac, 5V logic output, linear current or linear voltage to drive external devices. There are six types of alarms plus a dwell timer that can be configured for the third output. SC60 Series Controllers are fully programmable and can accept PT100 and thermocouple types J, K, T, E, B, R, S, N, L with no modifications. The input signal is digitized by using a 18-bit A to D converter. Its fast sampling rate allows the unit to control fast processes

Digital communications RS-485 or RS-232 (excluding SCN60) are available as an additional option. These options allow the units to be integrated with supervisory control system and software.

A programming port is available on the units for automatic configuration, calibration and testing without the need to access the keys on the front panel.

## OVERVIEW OF THE FEATURES

### High Accuracy

The SC60 Series controllers are manufactured with custom designed ASIC(Application Specific Integrated Circuit) technology which contains a 18-bit A to D converter for high resolution measurement (true 0.1 BF resolution for thermocouple and PT100) and a 15-bit D to A converter for linear current or voltage control output. The ASIC technology provides improved operating performance, low cost, enhanced reliability and higher density.

### Fast Sampling Rate

The sampling rate of the input A to D converter reaches 5 times/second. The fast sampling rate allows these controllers to control fast processes.

### Fuzzy Control

The function of Fuzzy control is to adjust PID parameters from time to time in order to make manipulation output value more flexible and adaptive to various processes. The results is to enable a process to reach a predetermined set point in the shortest time, with the minimum of overshoot and undershoot during power-up or external load disturbance.

### Digital Communication

The SC60 Series Controllers are equipped with RS-485 or RS-232 interface card to provide digital communication. By using a twisted pair wire, up to 247 units can be connected together via RS-485 interface and to a host computer.

### Programming Port

A programming port is used to connect the controllers to a hand-held programmer or a PC for quick configuration. Also controllers can be connected to an ATE system for automatic testing & calibration via this port.

### Auto-Tune

The auto-tune function allows the user to simplify initial setup for a new system. A smart algorithm is provided to obtain an optimal set of control parameters for the process, and it can be applied either as the process is warming up (cold start) or as the process has been in steady state (warm start).

### Lockout Protection

According to the actual security requirement, one of four lockout levels can be selected to prevent the units from being changed.

### Bumpless Transfer

Bumpless transfer allows the controller to continue to control by using its previous value when the sensor fails (breaks). Hence, the process can be well controlled temporarily as in the normal condition.

### Soft-Start Ramp

The ramping function is performed during power up as well as any time the set point is changed. It can be ramping up or ramping down. The process value will reach the set point with a predetermined constant rate.

### Digital Filter

A first order low pass filter with a programmable time constant is used to improve the stability of process value. This is particularly useful in certain application where the process value is too unstable to be read.

## SPECIFICATIONS

### Power Supply

90 - 264 VAC, 47 - 63 Hz, 12VA, 5W maximum

11 - 26 VAC / VDC, 12VA, 5W maximum

### Signal Input

Type	Range	Accuracy @ 25 °C	Input Impedance
J	-120 °C - 1000 °C (-184 °F - 1832 °F)	±2 °C	2.2 MΩ
K	-200 °C - 1370 °C (-328 °F - 2498 °F)	±2 °C	2.2 MΩ
T	-250 °C - 400 °C (-418 °F - 752 °F)	±2 °C	2.2 MΩ
E	-100 °C - 900 °C (-148 °F - 1652 °F)	±2 °C	2.2 MΩ
B	0 °C - 1820 °C (32 °F - 3308 °F)	±2 °C (200°C-1820°C)	2.2 MΩ
R	0 °C - 1767.8 °C (32 °F - 3214 °F)	±2 °C	2.2 MΩ
S	0 °C - 1767.8 °C (32 °F - 3214 °F)	±2 °C	2.2 MΩ
N	-250 °C - 1300 °C (-418 °F - 2372 °F)	±2 °C	2.2 MΩ
L	-200 °C - 900 °C (-328 °F - 1652 °F)	±2 °C	2.2 MΩ
PT100 (DIN)	-210 °C - 700 °C (-346 °F - 1292 °F)	±0.4 °C	1.3 KΩ
PT100 (JIS)	-200 °C - 600 °C (-328 °F - 1112 °F)	±0.4 °C	1.3 KΩ
mV	-8mV - 70mV	±0.05 %	2.2 MΩ
mA	-3mA - 27mA	±0.05 %	70.5Ω
V	-1.3V - 11.5V	±0.05 %	302 KΩ

**Resolution:** 18 bits

**Sampling Rate:** 5 times / second

### Maximum Rating:

-2 VDC minimum, 12 VDC maximum

( 1 minute for mA input )

### Temperature Effect:

± 1.5 uV / BC for all inputs except mA input

± 3.0 uV / BC for mA input

### Sensor Lead Resistance Effect:

T/C: 0.2 uV / ohm

3-wire RTD: 2.6 °C / ohm of resistance difference of two leads

2-wire RTD: 2.6 °C / ohm of resistance sum of two leads

**Burn-out Current:** 200 nA

**Common Mode Rejection Ratio ( CMRR ):** 120 dB

**Normal Mode Rejection Ratio ( NMRR ):** 55dB

### Sensor Break Detection:

Sensor open for TC, RTD and mV inputs

Sensor short for RTD input

below 1 mA for 4-20 mA input

below 0.25V for 1 - 5 V input

### Sensor Break Responding Time

Within 4 seconds for TC, RTD and mV inputs

0.1 second for 4-20 mA and 1 - 5 V inputs

### Output 1 / Output 2

#### Relay Rating:

2A/240 VAC, life cycles 200,000 for resistive load

#### Pulsed Voltage:

Source Voltage 5V, current limiting resistance 66 Ω

### Linear Output Characteristics

Type	Zero Tolerance	Span Tolerance	Load Capacity
4-20 mA	3.8-4 mA	20-21 mA	500 max.
0-20 mA	0 mA	20-21 mA	500 max.
0 ~ 5 V	0 V	5 ~ 5.25 V	10 K min.
1 ~ 5 V	0.95 ~ 1 V	5 ~ 5.25 V	10 K min.
0 ~ 10 V	0 V	10 ~10.5 V	10 K min.

### Linear Output

**Resolution:** 15 bits

**Output Regulation:** 0.01 % for full load change

**Output Settling Time:** 0.1 sec. ( stable to 99.9 % )

**Isolation Breakdown Voltage:** 1000 VAC

**Temperature Effect:** ± 0.0025 % of SPAN / °C

### Triac (SSR) Output

**Rating:** 1A / 240 VAC

**Inrush Current:** 20A for 1 cycle

**Min. Load Current:** 50 mA rms

**Max. Off-state Leakage:** 3 mA rms

**Max. On-state Voltage:** 1.5 V rms

### Insulation Resistance:

1000 Mohms min. at 500 VDC

**Dielectric Strength:** 2500 VAC for 1 minute

### Alarm 1 / Alarm 2

#### Alarm Relay:

Form C, Max. Rating 2A/240VAC, life cycles 200,000 for resistive load

#### Alarm Functions:

Dwell timer, Deviation High / Low Alarm, Deviation

Band High / Low Alarm, PV High / Low Alarm

**Alarm Mode:** Normal, Latching,

Hold, Latching / Hold

**Dwell Timer:** 0.1

- 4553.6 minutes

### Data Communication

#### Interface:

RS-232 ( 1 unit ), RS-485 ( up to 247 units )

**Protocol:** Modbus Protocol RTU mode

**Address:** 1 - 247

**Baud Rate:** 2.4 ~ 38.4 Kbits/sec

**Data Bits:** 7 or 8 bits

**Parity Bit:** None, Even or Odd

**Stop Bit:** 1 or 2 bits

**Communication Buffer:** 160 bytes

### Control Mode

#### Output 1:

Reverse ( heating ) or direct ( cooling ) action

#### Output 2:

PID cooling control, cooling P band 50~300% of PB, dead band -36.0 ~ 36.0 % of PB

#### ON-OFF:

0.1 - 90.0 ( LF ) hysteresis control ( P band = 0 )

**P or PD:** 0 - 100.0 % offset adjustment  
**PID:** Fuzzy logic modified  
 Proportional band 0.1 ~ 900.0 LF.  
 Integral time 0 - 1000 seconds  
 Derivative time 0 - 360.0 seconds  
**Cycle Time:** 0.1 - 90.0 seconds  
**Manual Control:** Heat (MV1) and Cool (MV2)  
**Auto-tuning:** Cold start and warm start  
**Failure Mode:**  
 Auto-transfer to manual mode while sensor break or  
 A-D converter damage  
**Ramping Control:**  
 0 - 900.0 LF/minute or  
 0 - 900.0 LF/hour ramp rate

### Environmental & Physical

**Operating Temperature:** -10 to +50 °C  
**Storage Temperature:** -40 to +60 °C  
**Humidity:** 0 - 90 % RH (non-condensing)  
**Moldings:** Flame retardant polycarbonate

### Approval Standards

**Safety:**  
 UL61010C-1  
 CSA C22.2 No. 24-93  
 EN61010-1 (IEC1010-1)  
**Protection Class:**  
 IP54 front panel, IP65 (Option)  
 Ip20 Housing and Terminals  
**EMC:**

EN61326

## ORDER CODES

Model **SC**  **60** -

#### SIZE

48 x 48 mm  
 48 x 96 mm  
 72 x 72 mm  
 96 x 96 mm

S  
M  
N  
L

#### POWER SUPPLY

90...264 VAC, 50/60 Hz  
 11...26 VAC or VDC

A  
D

#### SIGNAL INPUT

Temperature: Thermocouple or RTD  
 4-20 mA  
 0-20 mA  
 0-10 VDC

1  
2  
3  
4

#### OUTPUT #1

None  
 Relay 2A @ 240 VAC  
 Pulsed voltage to drive SSR, 5V/30 mA  
 4-20 mA / 0-20 mA isolated  
 1-5 VDC / 0-5 VDC isolated  
 0-10 VDC isolated  
 Triac output, 1A @ 240 VAC, SSR

0  
1  
2  
3  
4  
5  
6

#### OUTPUT #2

None  
 Relay 2A @ 240 VAC  
 Pulsed voltage to drive SSR, 5V/30 mA  
 4-20 mA / 0-20 mA isolated  
 1-5 VDC / 0-5 VDC isolated  
 0-10 VDC isolated  
 Triac output, 1A @ 240 VAC, SSR

0  
1  
2  
3  
4  
5  
6

#### ALARM

None  
 Relay 2A @ 240 VAC

0  
1

#### COMMUNICATION

Without  
 RS-485 interface  
 RS-232 interface

0  
1  
2



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